

CLAIMS

1. A method for use in displaying an expression phenomenon in a living matter in a system comprising memorizing means that memorizes, in a cell unit or a site unit of the living matter along a time axis, data indicative of a shape thereof and an expression data associated with the degree of gene expression; and processing means adapted to obtain said data indicative of the shape and expression data that are memorized in said memorizing means to visualize and display the gene expression phenomenon on a display screen, wherein said method characterized by comprising:

a first step of displaying as a three-dimensional image on the display screen a shape of the living matter of a cell or site of which expression phenomenon is observed;

a second step of setting a viewpoint on a three-dimensional space where the gene expression phenomenon in the shape of the living matter displayed is to be observed; and

a third step of reading the gene expression data of the cell or the site in the shape of the living matter out of said memorizing means, creating a three-dimensional image representing the expression phenomenon at the viewpoint set at said second step or at a fixed viewpoint, to display it in one color or multiple colors in various scales depending on a frequency of expression of a gene in the subject cell or site.

2. A method as claimed in Claim 1, characterized by chronologically displaying a change in shape of a cell or site associated with embryogenesis of gene expression phenomena; and displaying as an animation a change of a three-dimensional image representing an expression phenomenon from a certain viewpoint at a certain instant of time.

3. A method as claimed in Claim 1, characterized by chronologically displaying a change in shape of a cell or site of the living matter caused by an external stimulation or a change in shape of a cell or site caused by the living activities of its own; and displaying as an animation a change of a three-dimensional image representing an expression phenomenon from a certain viewpoint at a certain instant of time.

4. A method as claimed in Claim 1, characterized by displaying in parallel three-dimensional images representing expression phenomena for each cell or site of two or more living matters.

5. A method as claimed in Claim 4, characterized by comparing the three-dimensional images representing expression phenomena for each cell or site of two or more living matters to visually display similarities therebetween in a predetermined display format.

6. A method as claimed in Claim 1, characterized by mapping an expression data of a cell or site to be observed on coordination points in a color space of the three primary colors which is based on a data value thereof to display it as color information corresponding to the individual coordination points.

7. A method as claimed in Claim 1, characterized by mapping expression data of two or more cells or sites on coordination points in a color space of the three primary colors which is based on data values thereof to display them in parallel as color information corresponding to the individual coordination points.

8. A method as claimed in Claim 1, characterized by cutting imaginarily a three-dimensional image representing the expression phenomenon displayed, at a plane or a curved plane designated in a three-dimensional space to display an image representing the expression phenomenon along the cutting plane.

9. A method as claimed in Claim 1, characterized by displaying information about the gene expressed in a designated cell or site as a string of characters or as graphics, in response to an operation that designates the cell or site on a three-dimensional image representing the expression phenomenon displayed.

10. A method as claimed in Claim 1, characterized by coordinating a three-dimensional image representing the expression phenomenon with a pedigree diagram on embryogenesis for display.

11. A method as claimed in Claim 10, characterized by displaying a three-dimensional image representing the expression phenomenon in the designated cell, in response to an operation that designates a cell on the pedigree diagram.

12. A method as claimed in Claim 10, characterized by displaying a three-dimensional image representing the expression phenomenon in the designated cell before and after differentiation, in response to an operation that designates a cell on the pedigree diagram.

13. A method as claimed in Claim 10, characterized by displaying expression data of a designated cell as a string of

characters or as graphics, in response to an operation that designates a cell on the pedigree diagram.

14. A method as claimed in Claim 1, characterized by coordinating and displaying, in a predetermined display format, a three-dimensional image of the expression phenomenon and a position of a gene on a gene map that causes expression.

15. A method as claimed in Claim 1, characterized by coordinating and displaying, in a predetermined display format, three-dimensional images of the expression phenomenon of a gene in two or more cells or sites and a position of a gene on a gene map that causes expression.

16. A system for visualizing an expression phenomenon of a gene to display it on a display screen, characterized by comprising:

first memorizing means that memorizes, in a cell unit or a site unit of a living matter, data indicative of a shape thereof along a time axis;

second memorizing means that memorizes an expression data associated with the degree of expression of a gene along a time axis;

first processing means adapted to obtain said data indicative of the shape memorized in said first memorizing means to display, on the display screen as a three-dimensional image, a shape of the living matter at the cell or site where the expression phenomenon is to be observed;

viewpoint setting means for setting a viewpoint on a three-dimensional space to observe the expression phenomenon in the shape of the living matter displayed;

second processing means adapted to read the data about the gene expression at the cell or site in the shape of the living

matter out of said second memorizing means to create a three-dimensional image representing an expression phenomenon at the viewpoint set by said viewpoint setting means or at a fixed viewpoint, thereby displaying it in one color or multiple colors depending on a frequency of expression of the gene in the subject cell or site.

17. A system as claimed in Claim 16, characterized in that said system is configured with separate computers in which a computer that manages said first and second memorizing means is connected via a network with a computer comprising said first and second processing means.

18. A system as claimed in Claim 16, characterized in that said system is configured with separate computers in which a computer comprising said second memorizing means is connected via a network with a computer comprising said first memorizing means as well as said first and second processing means.

19. A system as claimed in Claim 16, characterized in that said first and second memorizing means and said first and second processing means are stored in a single computer or are distributed among and stored in two or more computers connected with each other via a network.

20. A system for use in displaying an expression phenomenon in a living matter, comprising a client computer and a server computer connected to each other via a network, said system being adapted to visualize an expression phenomenon in a gene to display it on a display screen on the client computer in response to a request from the client computer, said system being characterized in that:

said server computer comprises:

first memorizing means that memorizes, in a cell unit or a site unit of a living matter, data indicative of a shape thereof along a time axis;

second memorizing means that memorizes an expression data associated with the degree of expression of a gene along a time axis;

first processing means adapted to receive, from said first memorizing means, the data indicative of the shape of the living matter required by said client computer and create a three-dimensional image of the shape of the living matter at the cell or site where the expression phenomenon is to be observed, to send it back to the requesting client computer; and

second processing means adapted to receive, from said second memorizing means, data indicative of expression of the gene at the cell or site in the shape of the living matter produced as the three-dimensional image sent to the client computer, in response to information received from said client computer about a viewpoint on a three-dimensional space where the expression phenomenon in the shape of the living matter is to be observed, and create a three-dimensional image in one color or multiple colors in various scales, the image representing the expression phenomenon at the viewpoint designated by the information about the viewpoint or at a fixed viewpoint, to send it back to the requesting client computer;

said client computer comprising:

first designation means for designating a living matter to be observed;

second designation means for designating a viewpoint on a three-dimensional space where an expression phenomenon is to be observed; and

display means for displaying a three-dimensional image representing a shape of the living matter and a three-

dimensional image representing the expression phenomenon, that are received from said server computer.

21. A system as claimed in Claim 20, characterized in that either one or both of said first and second memorizing means is/are included in a different server computer from said server computer.

22. A program for use in displaying an expression phenomenon in a living matter which is associated with a method for use in displaying an expression phenomenon in a living matter as claimed in any one of Claims 1 to 15.